

# Notice of Allowability

Application No.

10/642,658

Examiner

Pamela E Perkins

Applicant(s)

SATO ET AL.

Art Unit

2822

aw

-- **Th MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to the amendment filed on 28 April 2004.
2. ☒ The allowed claim(s) is/are 2-11.
3. ☒ The drawings filed on 19 August 2003 are accepted by the Examiner.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) ☒ All b) ☐ Some\* c) ☐ None of the:
    1. ☐ Certified copies of the priority documents have been received.
    2. ☒ Certified copies of the priority documents have been received in Application No. 09/905,887.
    3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.  
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
  6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
    - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date \_\_\_\_\_.
    - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

## Attachment(s)

- |   |  |
|---|--|
| 1. <input type="checkbox"/> Notice of References Cited (PTO-892)  | 5. <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)            |
| 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                | 6. <input type="checkbox"/> Interview Summary (PTO-413),<br>Paper No./Mail Date _____. |
| 3. <input type="checkbox"/> Information Disclosure Statements (PTO-1449 or PTO/SB/08),<br>Paper No./Mail Date _____ | 7. <input type="checkbox"/> Examiner's Amendment/Comment                               |
| 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit<br>of Biological Material          | 8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance   |
|   | 9. <input type="checkbox"/> Other _____  |

  
**AMIR ZARABIAN**  
**SUPERVISORY PATENT EXAMINER**  
**TECHNOLOGY CENTER 2800**

### **DETAILED ACTION**

This office action is in response to the filing of the amendment on 28 April 2204.

Claims 2-11 are pending; claim 1 has been cancelled.

### ***Allowable Subject Matter***

Claims 2-11 are allowed.

### ***Reasons for Allowance***

The following is an examiner's statement of reasons for allowance: The following is an examiner's statement of reasons for allowance: prior art does not anticipate, teach, or suggest a manufacturing method of a semiconductor integrated circuit device where a source gas containing a monosilane gas and an ammonia gas is fed to the vicinity of a main surface of a semiconductor wafer heated to a temperature not less than a thermal decomposition temperature of the monosilane gas and the ammonia gas in a thermal CVD reactor, and decomposing the monosilane gas and the ammonia gas in the vicinity of the main surface of the semiconductor wafer with the reactor operating under cold-wall thermal CVD conditions, thereby depositing a silicon nitride film by cold-wall thermal CVD over the main surface of the semiconductor wafer placed in a gas atmosphere containing the monosilane gas and the ammonia gas, wherein a flow rate ratio of the ammonia gas to the monosilane gas is within a range of 150 to 750 and a pressure of the gas atmosphere is within a range of 37 kpa to 50 kpa.

For example, Ohta et al. (6,268,295) disclose a method of making a semiconductor device where a first silicon nitride layer is formed by chemical vapor deposition (CVD) over a substrate, forming a gate electrode over the substrate, forming a second silicon nitride layer by CVD over the gate electrode anisotropically etching the second silicon nitride layer to form sidewall spacers adjacent to the gate electrode, forming a third silicon nitride layer by CVD over the gate electrode, forming a silicon oxide layer over the third silicon nitride layer and etching a contact hole through the third silicon nitride layer and the silicon oxide layer. Ohta et al. further disclose forming the first, second and third silicon nitride layers at three different flow rates to have three different etching rates, wherein the third nitride layer has the largest flow rate and the second silicon nitride layer flow rate is the smallest. Ohta et al. disclose forming the silicon nitride layers in CVD chamber where a single wafer is placed in the chamber, inserting ammonia and monosilane or dichlorosilane gases into the chamber and heat the wafer with a heating lamp.

However, Ohta et al. do not disclose, anticipate, teach, or suggest feeding a source gas containing a monosilane gas and an ammonia gas to the vicinity of a main surface of a semiconductor wafer heated to a temperature not less than a thermal decomposition temperature of the monosilane gas and the ammonia gas in thermal CVD reactor and decomposing the monosilane gas and the ammonia gas in the vicinity of the main surface of the semiconductor wafer with the reactor operating under cold-wall thermal CVD conditions, thereby depositing a silicon nitride film by cold-wall thermal CVD over the main surface of the semiconductor wafer placed in a gas

atmosphere containing the monosilane gas and the ammonia gas, wherein a flow rate ratio of the ammonia gas to the monosilane gas is within a range of 150 to 750 and a pressure of the gas atmosphere is within a range of 37 kpa to 50 kpa.

Oyobe et al. (4,940,851) disclose a method of forming a layer on a substrate where a semiconductor wafer is placed in a cold-wall thermal CVD apparatus for film formation. However, Oyobe et al. do not disclose, anticipate, teach or suggest feeding a source gas containing a monosilane gas and an ammonia gas to the vicinity of a main surface of a semiconductor wafer heated to a temperature not less than a thermal decomposition temperature of the monosilane gas and the ammonia gas, decomposing the monosilane gas and ammonia gas in the vicinity of the main surface of the semiconductor wafer, thereby depositing a silicon nitride film over the main surface of the semiconductor wafer, wherein a flow rate ratio of the ammonia gas to the monosilane gas is within a range of 150 to 750 and a pressure of the gas atmosphere is within a range of 37 kpa to 50 kpa.

The prior art made of record in this action does not anticipate, teach, or suggest a manufacturing method of a semiconductor integrated circuit device where a source gas containing a monosilane gas and an ammonia gas is fed to the vicinity of a main surface of a semiconductor wafer heated to a temperature not less than a thermal decomposition temperature of the monosilane gas and the ammonia gas in a thermal CVD reactor, and decomposing the monosilane gas and the ammonia gas in the vicinity of the main surface of the semiconductor wafer with the reactor operating under cold-wall thermal CVD conditions, thereby depositing a silicon nitride film by cold-wall

thermal CVD over the main surface of the semiconductor wafer placed in a gas atmosphere containing the monosilane gas and the ammonia gas, wherein a flow rate ratio of the ammonia gas to the monosilane gas is within a range of 150 to 750 and a pressure of the gas atmosphere is within a range of 37 kpa to 50 kpa.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Pamela E Perkins whose telephone number is (571) 272-1840. The examiner can normally be reached on Monday thru Friday, 9:00am to 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

PEP

  
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